

CLAIMS

1. A method for use in an automated storage apparatus for physically moving digital data storage units relative to at least one digital data transfer device, the method comprising:
 - a) recognizing a designated one of said digital data storage units as a reference unit for diagnostic use, said unit comprising at least one storage portion; and
 - b) using a record of data transfer operation occurrences performed relative to the or each storage portion to limit the number of data transfer operations performed on the or each storage portion.
2. The method of claim 1, further comprising adding a data transfer operation occurrence relative to said storage portion to said record each time a data transfer operation is performed on said storage portion.
3. The method of claim 1, further comprising limiting to one the number of data transfer operations performed on the or each said storage portion, whereby no data transfer operation is performed on a previously used said storage portion.
4. The method of claim 1, wherein said storage unit comprises a tape storage medium and a non-volatile memory device, said method further comprising storing on said non-volatile memory device at least one of (i) the data transfer

operation occurrence record and (ii) information for identifying said storage unit as a designated reference unit.

5. The method of claim 1, further comprising automatically inserting said reference unit in said one data transfer device and performing a reference data transfer operation in response to an error level in data transferred by the transfer device on each of said transfer devices exceeding a threshold.
6. The method of claim 1, comprising monitoring an error level in data transferred during said reference data transfer operation, and determining thereby whether a cause of the excessive error level originates from said one data transfer device or from a said data storage unit last removed from said data transfer device.
7. The method of claim 1, wherein said data transfer operation consists of a write operation followed by a read operation performed on data written during said write operation.
8. The method of claim 1, wherein the recognizing step is performed by using at least one of (i) identity information stored on said reference unit, (ii) detecting the presence of one of said reference units in a specially designated holding location, and (iii) information obtained by tracking subsequent movement of the reference unit.

9. The method of claim 1, wherein said reference unit is a multi-function storage unit comprising i) a data storage tape comprising said at least one storage portion and ii) a tape-cleaning band, the method further comprising holding the multi-function storage unit in a dedicated multi-function storage unit holding area, and moving said multi-function storage unit to a data transfer device for use as a cleaning unit or as a reference unit.
10. A storage medium storing a program of machine readable instructions for causing a digital processor apparatus to perform the method of claim 1.
11. A carrier having stored thereon a program of machine readable instructions for causing a digital processor apparatus to perform the method of claim 1.
12. A logic circuit including interconnected electrically conductive elements for performing the method of claim1.
13. A control apparatus for use in at least one of an automated storage apparatus or a data transfer device, said control apparatus comprising:
 - a) means for recognizing a digital data storage unit as a reference unit for diagnostic use, said unit comprising at least one storage portion;
 - b) means for using a record of data transfer operation occurrences performed relative to the or each storage portion for limiting the number of data transfer operations performed on the or each storage portion; and

- c) means for adding to said record a data transfer operation occurrence relative to said storage portion each time a data transfer operation is performed on said storage portion.

14. A digital data transfer device for transferring data to and from digital data storage units, said device being arranged for:

- a) recognizing a digital data storage unit as a reference unit for diagnostic use, said reference unit comprising at least one storage portion;
- b) accessing a record of data transfer operations performed relative to the storage portion or each said storage portions of said reference unit; and
- c) using said record for limiting the number of data transfer operations performed on each said storage portions.

15. The digital data transfer device of claim 14, wherein the device is arranged for adding to said record any occurrence of a data transfer operation by said transfer device relative to the storage portion of said reference unit or each of said storage portions of said reference unit.

16. The digital data transfer device of claim 14, wherein the device is arranged for limiting the number of data transfer operations to one per storage portion, whereby a version of said storage portion is provided for any desired reference data transfer operation.

17. The digital data transfer device of claim 14, wherein said device is arranged to store said record on said reference unit.

18. The digital data transfer device of claim 14, wherein said storage unit comprises a tape storage medium and a non-volatile memory device, and said non-volatile memory device is arranged to store said record.

19. The digital data transfer device of claim 14, wherein the device is arranged for monitoring error levels in data transferred by said transfer unit relative to said data storage units and, in response to detecting said error level being in excess of a predetermined threshold, for:

- a) initiating i) removal of said data storage unit presently inserted in said transfer unit and ii) inserting said reference unit; and
- b) performing a reference data transfer operation.

20. The digital data transfer device of claim 14, wherein the device is arranged for monitoring an error level in data transferred during said reference data transfer operation, and determining whether a cause of the excessive error level is in said data transfer device or in the data storage unit last removed from said data transfer device.

21. The digital data transfer device of claim 14, wherein the device is arranged for recognizing said digital data storage unit as being said designated reference unit for diagnostic use in response to at least one of (i) identity information being

stored on said reference unit and (ii) information received from a controller of automated apparatus for moving, loading and unloading storage units.

22. The digital data transfer device of claim 14, arranged for use with a multi-function storage unit comprising i) a tape storage medium section having said at least one storage portion and ii) an abrasive cleaning tape section, said transfer device being arranged for recognizing said multi-function storage unit as a special type of reference unit, and for using an appropriate one of said sections of said multi-function storage unit for cleaning purposes or for reference purposes.
23. A digital data storage reference unit comprising i) at least one reference data storage portion and ii) a record of the number of times a data transfer operation has been performed relative to the or each of said storage portions for enabling maintenance of the data storage portion or each of said data storage portions in a predetermined reference condition.
24. The digital data storage reference unit of claim 23, further comprising a cartridge including a tape data storage medium and a fast access data storage device, said record being stored on said fast access storage device.
25. The digital data storage reference unit of claim 23, comprising a cartridge carrying an elongated multi-function band wound on at least one reel, said band comprising:
 - a) a first length including said at least one reference data storage portion; and

- b) a second length comprising abrasive cleaning medium, the second length being connected to and extending longitudinally away from said first length.
26. The digital data storage reference unit of claim 23, comprising identity information for enabling a digital data processor to recognize said unit as a reference unit for diagnostic use.

27. A digital data transfer device for transferring data to and from digital data storage units, said device being arranged for:
- a) recognizing one of said digital data storage units as a reference unit for diagnostic use, said reference unit comprising at least one storage portion;
 - b) accessing a record of data transfer operations performed relative to the storage portion of said reference unit or to each of said storage portions of said reference unit; and
 - c) using said record for limiting the number of data transfer operations performed on each of said storage portions; the digital data transfer device being further arranged for:
 - d) responding to an error level of data transferred by said transfer device relative to said data storage units being in excess of a predetermined threshold, for:
 - i) initiating a) removal of a said data storage unit presently inserted in said transfer unit and b) insertion of a said reference unit; and

- ii) performing a reference data transfer operation.

28. A digital data transfer device for transferring data to and from digital data storage units, said device being arranged for:

- a) recognizing one of said digital data storage units as a reference unit for diagnostic use, said reference unit comprising at least one storage portion;
- b) accessing a record of data transfer operations performed relative to said storage portion of said reference unit or each of said storage portions of said reference units; and
- c) using said record for limiting the number of data transfer operations performed on each said storage portion;
- d) the digital data transfer device being arranged for use with a multi-function storage unit comprising i) a tape storage medium section having said at least one storage portion and ii) an abrasive cleaning tape section, said transfer device being arranged for recognizing said multi-function storage unit as a special type of reference unit, and for using an appropriate one of said sections of said multi-function storage unit for cleaning purposes or for reference purposes, as required.